SMATV SYSTEM

Introduction to SMATV System

What is SMATV System?

Apa itu Sistem SMATV? ..

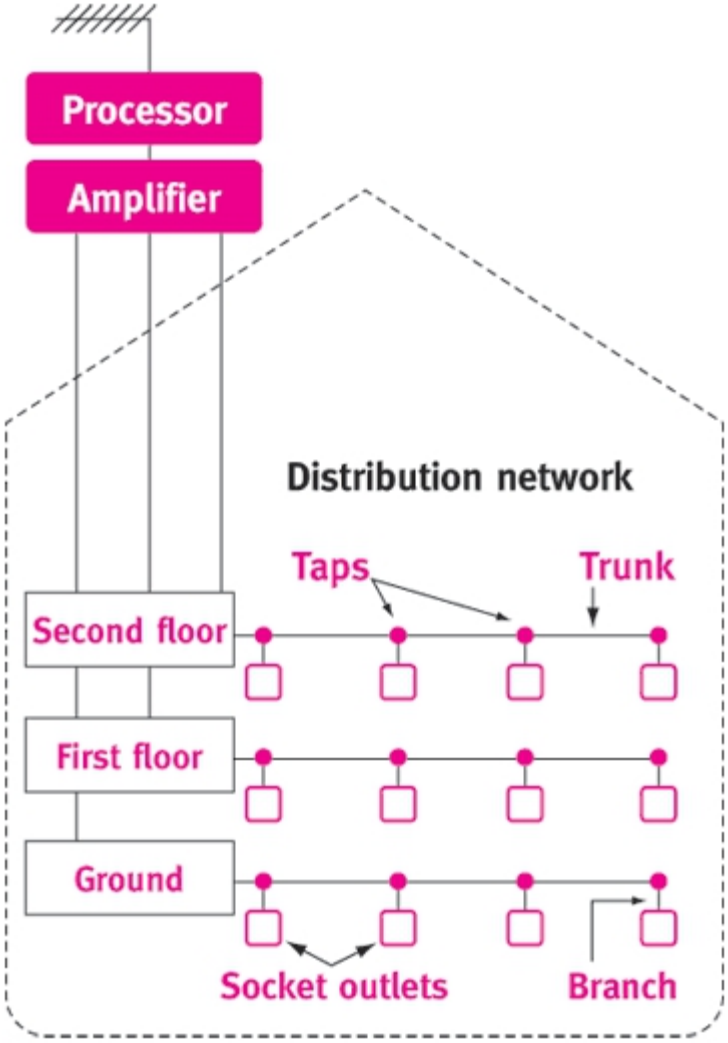
- Is a distribution system by which an area, building or premise are served with a television and radio systems fed from a common antenna.
- Prefix for Satellite(S) Master(M) Antenna(A) Television(TV)
- It can be used to transmit:-
  - RF Broadcast TV And Radio
  - Locally Modulated Sources
  - Satellite IF

Why SMATV?

- Imagine a 36 storey condominium block with 100 resident units
- What happen if each resident decided to put up their own antenna? Very ugly, unsightly and even dangerous
- Too many antennas would also interact with each other causing interference problems

How

- Let begin our understanding
- We need something to receive transmissions (many of them)
- There must be something to process all these transmissions
- Finally distribute them
- The terminologies that will be used are:-
  - Receiver
  - Headend/amplification
  - Distribution

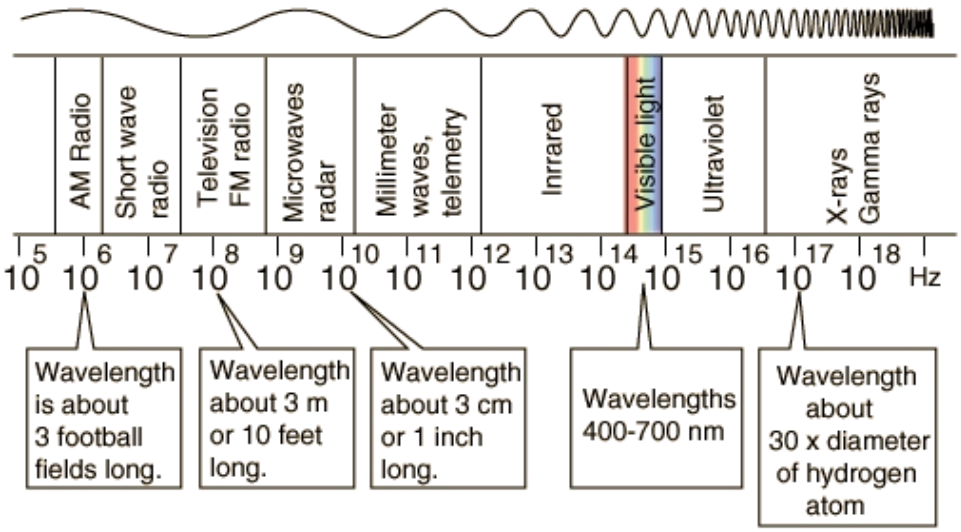


How (1) – Receiver

- To receive transmissions (signals), as simple as that
- What transmissions?
  - Terrestrial (my definition - normal earth boundary shared by common people). Think extra-terrestrial (E.T) and you will get it.
  - Satellite (ASTRO?)
- Terrestrial
  - Television channels
  - Myfreeview di Malaysia menggunakan DVB-T
  - Radio channels
- So which spectrum are we interested in?
- What is spectrum anyway?

How (2) – Spectrum

- Electromagnetic spectrum
- FM radio, 87.5 – 105 MHz
- Television:-
  - Very high frequency (VHF), 174 – 230 MHz
  - Ultra high frequency (UHF), 470 – 862 MHz
- Satellite:-
  - Ku (*kurtz-unter* or K under) band, 12 – 18 GHz
  - Europe and Astro use Ku band 10.7 – 12.75 GHz
  - Other bands: C, K and Ka



How (3) – Terrestrial Receiver

- To receive television and radio transmission requires antennas
- Antennas are generally characterised by:-
  - Number of elements – to receive transmission
  - Front to back ratio (in dB) – directionality
  - Gain (in dB)
  - Normally made of aluminium
- FM antenna
  - How many elements?

How (4) – Terrestrial Receiver

- VHF antenna
  - How many elements?
- UHF antenna
  - How many elements?
- Trivia: Do you notice the different number of elements required for each transmission? Why?

How (5) – Satellite Receiver

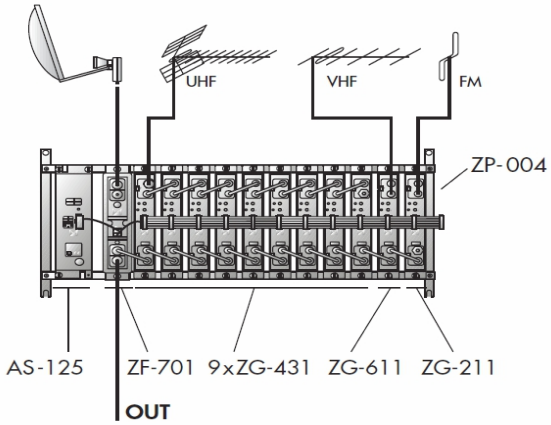
- To receive satellite transmission, ASTRO 10.7 – 12.75 GHz
- Diameter of ASTRO dish for SDU (single dwelling unit) is 60 cm. For SMATV use or MDU minimum is 80cm. Why?
- GHz signals are almost microwaves range. Very short wavelength and ordinary coaxial cable will not support. So how?
- Low noise block (LNB) acts as a low noise down converter and amplifier, 950 – 2150 MHz

How (6) – Headend/amplification

- Now the receivers have received all the transmissions what's next?
- Before that the common signal level of good terrestrial transmission is 60dBµV or 0dBmV
- Because it sat at the top, we called it headend.
- Generally consists of channelised amplifier, broadband amplifier, SAT/IF combiner, modulator etc.
- Must include power supply module, mounting rail and cabinet enclosure.

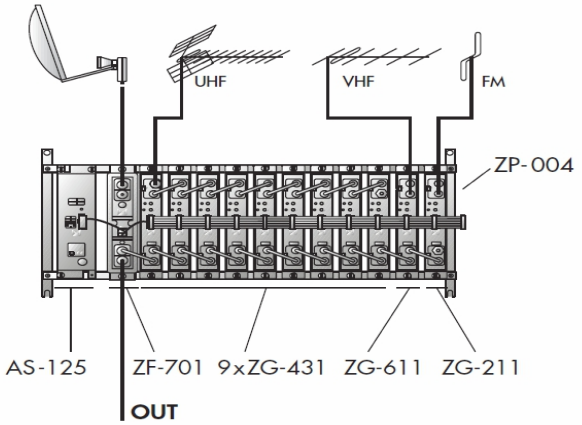
How (7) – Channelised Amplifier

- Receive one specific transmission and reject others, e.g: receive TV3 and reject others. Also called strip amplifier
- Several channelised amplifiers are then cascaded to form a system with a combined output
- The amplifier also amplify the signal to certain output level, thus gain and max output level are important
- Broadband amplifier amplify all band



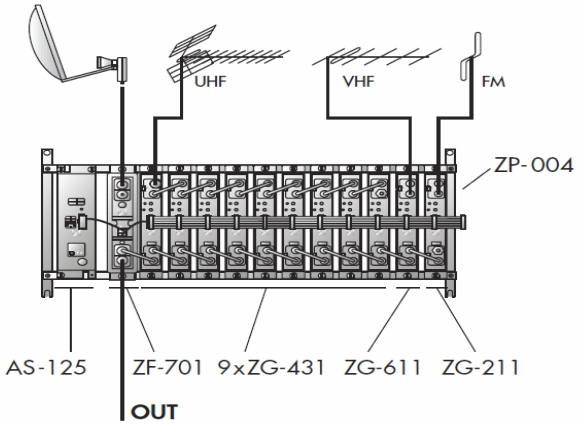
How (8) – SAT/IF combiner

- Amplify signal from LNB and mix with the rest of terrestrial signal from other channelised amplifiers
- Feed LNB with the required voltage signal and signal tone for polarity selection
- So after cascading and mixing the signal now consists of SAT+terrestrial
- Broadband amplifier amplify all band



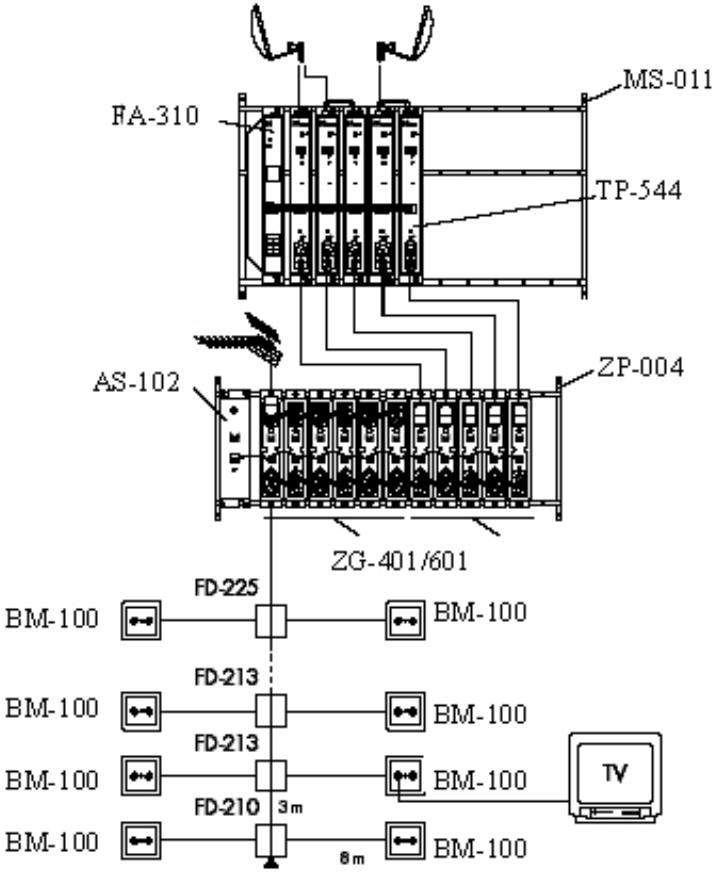
How (9) – Modulator

- Normally used for in-house entertainment
- Audio and video signal from e.g: DVD player is modulated to RF signal and injected into the system as one of the channels



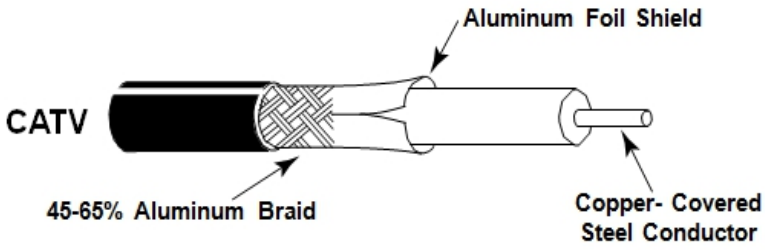
How (10) – Distribution

- Let's recap
  - ✓ We're now able to receive the channels through receivers (antenna & satellite dish)
  - ✓ The channels have been processed and amplified by the headend equipment
  - ✓ We have one (1) output
- So now we need to distribute this signal, how?
- Basically we need cable, splitter and tap-off (multiswitch untuk ASTRO)



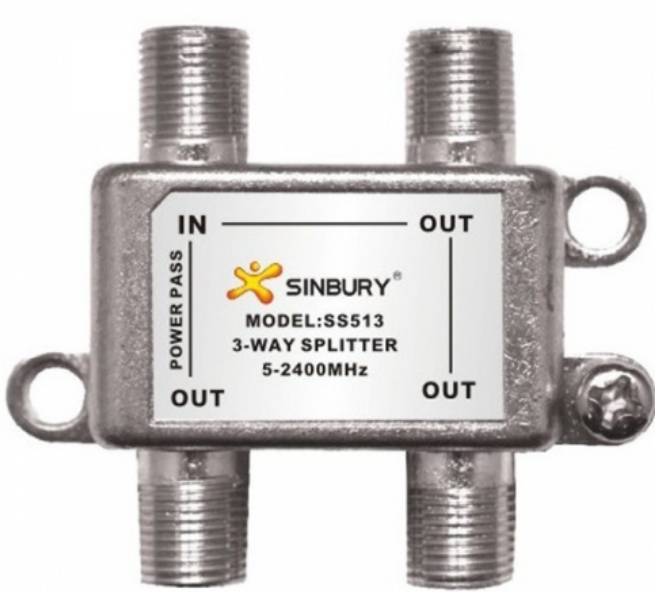
How (11) – Cable

- We need coaxial cable. What is coaxial?
- Vertical cabling using RG11
  - ✓ Min 14 awg
- Horizontal cabling using RG6
  - ✓ Min 18 awg
- 75Ω, bare copper covered steel (bccs) & double shielded
- Cable attenuation (loss) is a very important criteria (Refer specification)



How (12) – Splitter

- To split RF signal (as simple as that): 2 way, 3 way, 4 way etc.
- Splitting signal causes loss, theoretically based on dB calculation. E.g: 2 way perfect loss is 10 log(2) = 3dB. But in real world 4dB is more likely.
- We called this insertion loss. Loss is also proportionate to frequency (refer spec)
- Splitter must cover the frequency of the intended RF signal coverage



How (13) – Multiswitch

- Digital satellite such as ASTRO B-YOND uses 4 polarisation method which are horizontal high (HH), horizontal low (HL), vertical high (VH) and vertical low (VL)
- These polarisations need to be distributed in the SMATV system
- Multiswitch is used for this purpose

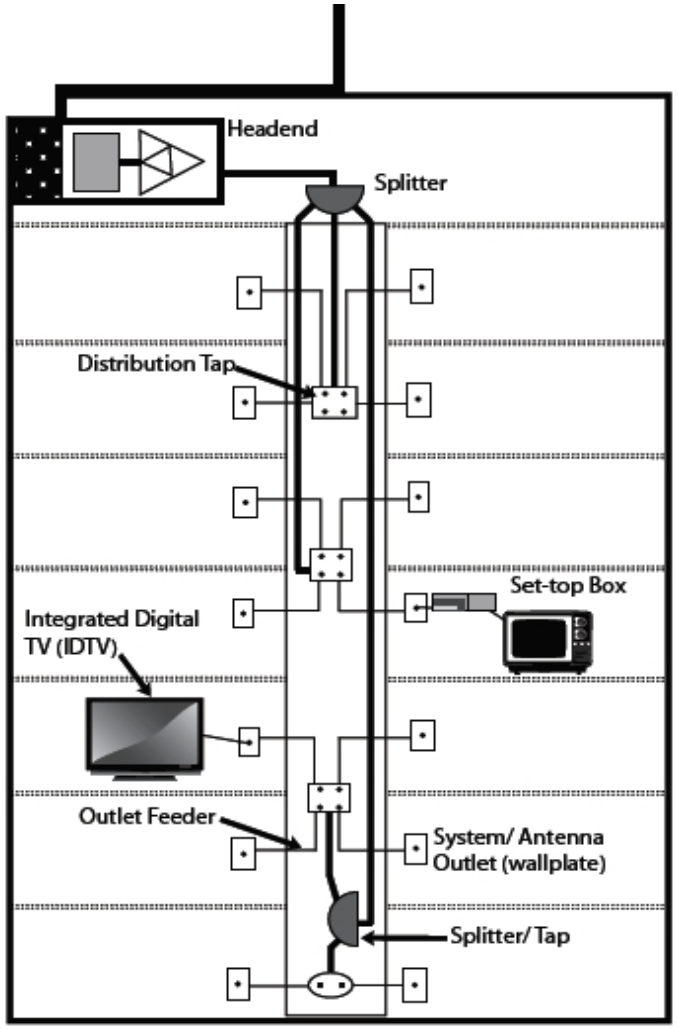
How (13) – Multiswitch

How (13) – Tap off

- They look similar to splitter, so what is the difference?
- Splitter is **normally** used when we want to split signal equally in the trunk line, whereas tap off is where we feed the TV. Also tap-tap isolation is usually better.
- Tap has insertion loss and tap loss.
- The same 4 way tap off can have different value of tap loss depending on our needs, why?

What (1) – Off air signal

- What is off air?
- What is the target value in our design?
- A good off-air signal should be approximately 0-5dBmV or 60-65dBµV (**check**: do you understand what these are?)
- Always remember that you cannot create something out of nothing! So if your building is surrounded by high valleys and cannot receive terrestrial off-air tv signal, don't bother designing the MATV system (except may be sattelite).



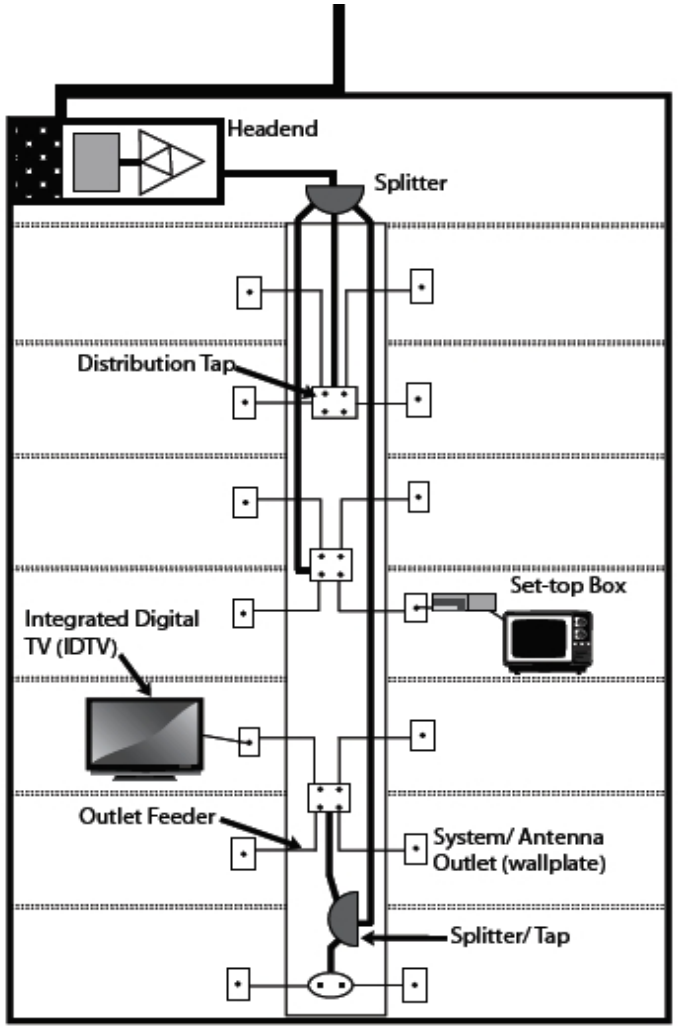
What (2) – Target value

- The target value for TV signal in our draft spec is 5dBmV (65 dBµV) to 15dBmV (75 dBµV), and -5dBmV (55 dBµV) to 5dBmV (65 dBµV) for radio.
- Too little, there will be no picture & too high, it will kill the electronics.
- All the distribution elements have loss (cable, splitter, tap off etc).
- The design principal is to make sure that we have enough signal at the head end to overcome all these losses and achieve the target value at the TV's end.
- Quick run through on the draft specification.

How – Calculation example

- The purpose of this calculation is to determine the minimum signal value at the headend output
- We will be looking at the loss experienced by the signal as it travelled through the distributionnetwork
- For this example we will be looking at the furthest point at the ground floor based on example on the right
- The signal path is :-

  headend – RG11 cable (10m) – 3w splitter – RG11 cable (30m) – 2w splitter – 2w tap – RG6 cable (10m) – outlet



How (2) – Calculation example

- The losses for the distribution components (assuming @ 1000MHz) are:-

  RG11 cable = 0.15dB/m

  RG6 cable = 0.2dB/m

  3w splitter (insertion loss) = 7.5dB

  2w splitter (insertion loss) = 5dB

  2w tap off (tap loss) = 10dB

  outlet (transfer loss) = 5dB

- Hence, the path loss is

  = 10(0.15) + 7.5 + 30(0.15) + 5 + 10 + 10(0.2) + 5

  = 35.5dB

How (3) – Calculation example

- Therefore if we required a minimum signal of 65dBµV at the outlet, the minimum output level required at the headend will be 65 + 35.5 = 100.5 dBµV
- The headend amplifier specified shall have an output level of 100.5 dBµV or higher

Unit Perunding Akustik

Thank You For Listening